CLAIMS

1. Method of determing a digital filter for seismic signals comprising the steps of:
defining contraints representing a filter for preserving signals representing reflection and/or refractions from sub-surface structure and suppressing noise signals in seismic signals; and
using an iterative process with each iteration further comprising the steps of:
- transforming a filter obtained from a previous iteration into a transform domain;
- applying in said transform domain first constraints;
- inverse transforming the filter with the applied constraints into a sample domain; and
- applying in said sample domain second constraints to obtain an iterated filter.

2. The method of claim 1 wherein each step of the iterative process includes the transform of the filter (coefficients) into the wavenumber or frequency-wavenumber domain and the inverse transform back into the spatial or temporal-spatial domain.

3. The method of claim 2 wherein in each step of the iterative process the filter is constrained to a predefined tolerance in the wavenumber or frequency-wavenumber domain.

4. The method of claim 2 wherein in each step of the iterative process the filter is constrained to a predefined response outside a finite region in the spatial or temporal-spatial domain.

5. The method of claim 2 wherein in each step of the iterative process the filter is constrained to a predefined response outside a finite region in the spatial or temporal-spatial domain and in each step of the iterative process the filter is constrained to a predefined tolerance in the wavenumber or frequency-wavenumber domain.

6. The method of claim 1 wherein the filter is obtained by applying alternating projection onto constraints defining convex sets of square summable sequences .

7. The method of claim 1 wherein the transform sampling/periodicity matrix of the transform in Cartesian coordinates is non-diagonal.

8. The method of claim 1, further comprising the step of distributing groups of receivers or single sensor seismic receivers so as to obtain seismic measurements on a staggered or hexagonal grid.

9. The method of claim 8 wherein the step of transforming comprises the use of a spatially staggered or hexagonal transformation.

10. The method of claim 9 wherein the step of transforming the signals comprises the use of a spatially staggered or hexagonal Fourier transformation.

11. The method of claim 1 wherein the filter is a zero-phase finite impulse response (FIR) filter.

12. The method of claim 1 wherein the filter has at least two dimensions.

13. The method of claim 1 wherein the filter is a 3D filter.